CHAPTER 5

PRINCIPLES OF POOL OPERATION

5-1. PATRON SANITATION.

Pool sanitation begins with bather supervision and discipline. For the most part, the rules governing good conduct and cleanliness are fairly uniform as published in various pool operations publications and as posted n walls and fences of public pools throughout the United States. Unfortunately, however, the seriousness of enforcing the rules is not stressed. Not until the pool operator understands the public health involvement can he/she fully appreciate the importance of enforcing every rule without exception.

5-2. BODILY INFECTION.

An obviously healthy patron wearing a small bandage may appear entirely harmless to an untrained bathhouse attendant. However, the bandage may be covering a common pimple or sore, that has festered with staphylcoccus bacteria. Although the highly localized infection presents no serious problem for the person afflicted, it does pose a significant health hazard if these same bacteria are washed from the infection and conveyed to other bathers.

5-3. SHOWERING AND EATING.

Much more difficult to relate to public health are the rules that require nude showers with warm water and soap and that prevent food, drink, or tobacco in the pool area. Permitting patrons to enter the pool unbathed can impair the efficiency of the disinfection system by as much as 50 percent. As indicated in discussions which follow, organic soil (usually harmless in itself) imposes a serious burden upon the chemical disinfectants and filtration system if allowed to accumulate in the pool.

5-4. WATER TREATMENT TECHNIQUES.

a. Since the contamination of swimming pool water to some extent is inevitable, water treatment techniques must be established to make the water safe for bathers. Such treatment is accomplished by the operation of three interrelated and interacting systems:

(1) A system for the recirculation and distribution of pool water.

(2) A system for feeding chemicals for disinfection and control of pH.

(3) A system for the removal of particles by filtration.

b. In this chapter these systems are discussed together to emphasize the manner in which they work together to accomplish the ultimate goal of safe, clear pool water. In subsequent chapters they are discussed individually to provide the reader with detailed knowledge of how each system performs.

5-5. RECIRCULATION.

a. The function of the swimming pool recirculation system is probably best described as a type of transportation system. Water is transferred from the pool, delivered to a station where it is filtered and chemically treated, and then returned to the pool. The round trip the water takes is described by the term "turnover." Turnover is expressed as the number of hours necessary to circulate a volume of water equal to the volume contained in the pool. Another method of expression is the number of times in 24 hours that the volume of the pool is circulated; i.e., turnover in 8 hours is a turnover of three.

b. Both in theory and practice, it has been determined that the typical public pool should be recirculated continuously at a rate equal to one turnover in each 6- to 8-hour period. The Law of Dilution as developed by Gage and Bidwell suggests that such a turnover rate will provide 95 percent to 98 percent dilution of soiled pool water with water that has been filtered and chemically treated. Gage and Bidwell's law has been largely upheld in practice, and the 6- to 8-hour turnover rate has generally become a standard for the operation of public pools.

5-6. FILTRATION.

Filtration is of some value for its capacity to remove bacteria and disease producing organisms. However, its primary function is to remove soil particles which, if not removed, would increase the need for chemical treatment and reduce the germ killing and oxidizing power of disinfection chemicals.

5-7. DISINFECTION.

a. The disinfection function is a complicated process involving rather intricate chemistry. Ideally, disinfection is accomplished by introducing a germ-killing chemical to pool water in sufficient strength to rapidly destroy bacteria. Chlorine, one of a group of chemicals referred to as "halogens," is the disinfecting agent most commonly used in public pools and is therefore used as a term of reference henceforth in this manual.

b. When chlorine is added to pool water, it combines chemically with the oxygen and hydrogen components of water to produce hypochlorous acid (HOCL) which attacks and kills bacteria.

c. Disinfection may also be accomplished with bromine and the chemistry involved is much the same. The chemical reaction produces a mild acid with germ killing properties approximately equal to those of hypochlorous acid.

d. Regardless of the disinfecting agent used, the primary goal is the same: to provide a uniformly distributed disinfection and oxidation residual of sufficient strength to rapidly destroy disease producing organisms in pool water.

e. Although chlorination is primarily for disinfection to kill microorganisms, it serves another very important and useful purpose. The commonly used chlorine and bromine products possess strong oxidizing properties which cause them to react with and destroy many foreign materials other than bacteria. Many of these materials, if not destroyed by oxidation, would impart undesirable characteristics to the water such as turbidity, color or odor. This chemical destruction of foreign material plays an important part in the filtration/disinfection process, as is discussed in chapter 6.

5-8. pH CONTROL.

a. pH is a chemical abbreviation used to describe the presence of the hydrogen ion in water. Although somewhat inaccurate, pH is often explained as a measure of the relative acidity or alkalinity of water.

b. pH is measured on a scale of 0 to 14. The midpoint, 7 is said to be precisely neutral, above which alkalinity becomes progressively greater, and below which acidity becomes progressively greater. In swimming pool water it is important to maintain a slightly alkaline condition between 7.2 and 7.8. Problems develop when this range is exceeded on either side. A high pH, for example, can cause precipitation of dissolved minerals such as calcium and iron with resulting discoloration and turbidity. Low pH can cause serious corrosive damage to metals in the recirculation system. Both high and low pH will cause eye irritation.

c. From a public health viewpoint, the most serious effect of improper pH control is the reduced efficiency of the disinfection process. As pH rises above 8.0, chlorine reactions tend to produce an abundance of hypochlorite ion (OCL) rather than the desired hypochlorous acid (HOCL) greatly reducing germ-killing oxidizing powers. Sections 6.5 discusses a procedure of super chlorination that can be successfully used with high chlorine values and high pH under careful control. Also “breakpoint” chlorination, which is covered in paragraph 6.6, is effective in burning out the ammonia content of the pool water. As the pH value rises the chlorine residual progressively weakens. A pH value above 8.5 makes the chlorine virtually useless for disinfection and oxidation purposes.

d. The inexperienced pool operator is often surprised to discover that serious water problems have developed despite the fact that filters are functioning properly and chlorine residual reads strong in the chlorine test procedure. In such cases, the problem is often traced to the fact that pH has been permitted to drift well into the undesirable zone above 8.0 or below 6.8.

5-9. ECONOMY.

Money, materials, and water can be wasted if good economy is not practiced in pool operation. Pool equipment must be maintained to prevent frequent replacement of major items. Daily pool operations must be carefully controlled to prevent the waste of chemicals, manpower, and other items. If poor operation results in contaminated water, it may be necessary to drain the pool, thereby wasting thousands of gallons of water and placing the pool out of use for some time. Routine maintenance will often prevent expensive repairs to equipment, structures, and facilities.